Isoproterenol-induced cardiomyopathy and oxidative stress: a review of experimental models and insights

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Abstract:

Isoproterenol-induced cardiomyopathy is a valuable experimental model for studying various aspects of cardiovascular diseases. This model involves the administration of isoproterenol, a synthetic catecholamine and beta-adrenergic agonist, to induce cardiac stress and damage, thus mimicking conditions similar to human cardiomyopathy. The primary mechanism involves excessive stimulation of beta-adrenergic receptors, leading to increased heart rate, myocardial oxygen demand, and subsequent myocardial necrosis. This process is crucial for understanding pathophysiological changes observed in human heart diseases. The isoproterenol model has been extensively used to explore oxidative stress, inflammation, and apoptosis in the heart. Significant insights have been gained into molecular pathways of myocardial injury, such as the role of reactive oxygen species, inflammatory cytokines, and apoptotic signaling. These discoveries have enhanced the understanding of cardiomyopathies and other cardiovascular disorders. However, limitations exist. Isoproterenol-induced cardiomyopathy may not fully replicate all aspects of human heart diseases, and variations in dosage and administration protocols can lead to inconsistent results. The acute nature of induced damage may not accurately reflect the chronic progression of human cardiomyopathy. Future research directions include refining the model to better mimic chronic heart conditions, exploring genetic and molecular responses, and integrating this model with other experimental approaches to develop comprehensive treatment strategies. Despite its limitations, isoproterenol-induced cardiomyopathy remains a crucial tool for advancing knowledge and improving therapies for cardiovascular diseases.

Keywords:

Isoproterenol, cardiomyopathy, experimental model, cardiovascular diseases.